SOLDERING BY ELECTRICITY.

The engraving shows a soldering iron heated by the electric current, and capable of melting all kinds of solders, such as gold and silver solder, which have heretofore required a blowpipe to melt them. It may also be used for the more fusible solders employed in making tin ware. Now that the electric current is distributed so generally and is used

ELECTRIC SOLDERING IRON.

for all manner of purposes it seems quite practicable to employ it for soldering.

Figs. 1, 2, and 3 show one form of electric soldering iron, Fig. 1 being a perspective view, Fig 2 a section showing the switch for controlling the current, and Fig. 3 a detail view of the switch button. Figs. 4 and 5 are views of a modified form of the device. In Figs. 1 and 2 the electric conductors extend through and project beyond the handle, and embrace a piece of platinum or other material offering sufficient resistance to the passage of the electric current to become heated more or less according to the strength of the current. One of the conductors is separated near the upper end of the handle, and bridged by a button made partly of electrical conducting material and partly of insulating material, so that by turning the button the circuit may be completed or broken as circumstances may require. The device shown in Figs. 4 and 5 is on the same general principle, the only difference being that the handle is split lengthwise and the two portions are pressed apart by a spring. When apart to their fullest extent a hook attached to one of the conductors touches the other conductor and short circuits the current in the handle. When the two halves of the handle are pressed together the current passes through the refractory point.

When the point is heated to incandescence the tool may be used for melting either silver or gold solder. For melting soft solder the heat may be less intense.

This invention was recently patented by Mr. C. E. Ball, of Philadelphia, Pa.

Marketable Weight of Fish—Amendment of the Game Laws Suggested.

At a recent meeting of the Long Island Sportsmen's Association, held in this city, certain amendments of the New York State game laws, pertaining to the capture and sale of fishes, were suggested.

In the close season, if a box of trout should be sent to a dealer and he should open it on his stand in the presence of a citizen he might be heavily fined, although he had not sent for the trout, and did not know what the box contained

Mr. Eugene Blackford said that he had a lot of trout once sent to him on which he might have been fined $40,000. He thought the laws should be amended in such manner that only the guilty should be punished.

The marketable weight of fishes was also thought a proper subject for legislation. The following weights and sizes for different fishes were agreed upon; Bluefish, not under three-quarters of a pound; weakfish, not less than half a pound; sea bass, half a pound; porgies, half a pound; black bass, half a pound; yellow perch, one-third pound; white perch, one-quarter pound; mullet, one-quarter pound; butter fish, one-quarter pound; flounders, half a pound; sunfish, one-quarter pound; Spanish mackerel, one pound; brook trout, not less than four ounces. It was decided that dressed eels should not be less than twelve inches long, while eels not dressed might be sold fifteen inches long.

A motion was carried that between the sundown of Friday and sundown of Saturday, shad fishing in the Hudson river should be suspended and nets hauled up on the shad poles. This was to let the shad run up the river and spawn.

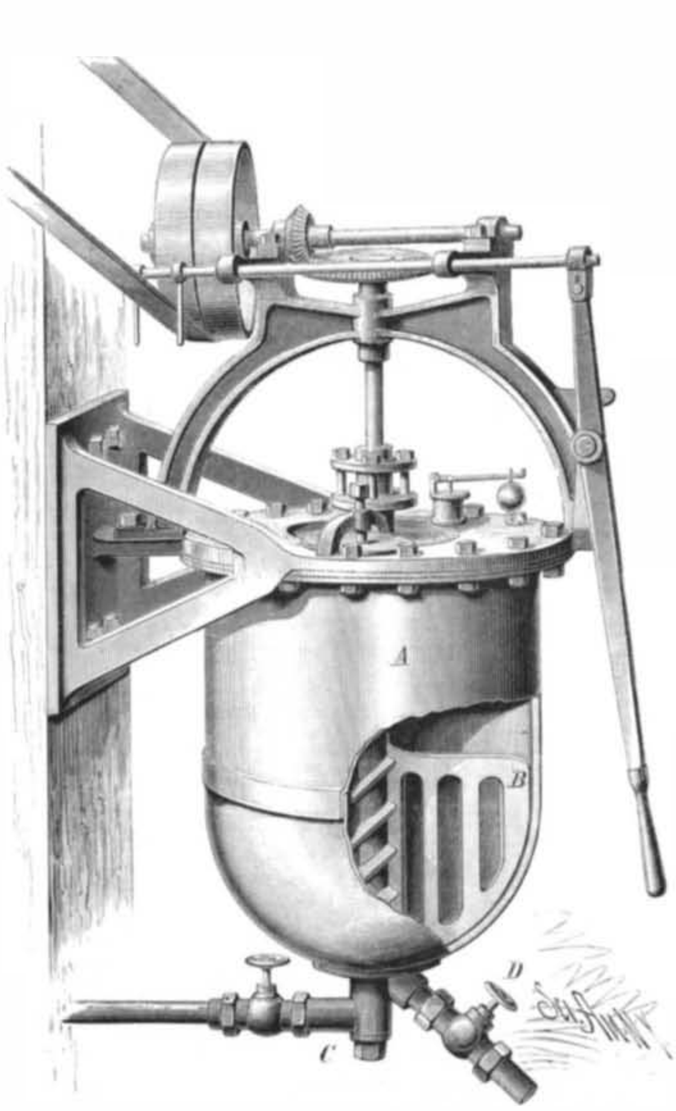
The Lick Telescope.

At a late meeting of the San Francisco Academy of Sciences. Professor Davidson read a letter from Dr. Hugo Schroeder, of Ober Ursel, near Frankfort-on-the-Main, intimating that he would like to undertake to make for the Lick Observatory a fifty inch refractor upon a new principle, with single in place of double lens objectives. Dr. Schroeder has been very successful in the manufacture of lenses; but his proposal failed to interest the Lick trustees, for sufficient reason that a contract had already been signed with the Clarks, of Cambridge, to make for the Lick telescope an achromatic object glass having thirty-six inches clear aperture. The cost is to be $50,000. The glass is to be finished within two years after the rough disks are obtained, and it is expected that these disks will be had before November 1, 1883.

APPARATUS FOR PREPARING STARCH FOR FINISHING LINEN AND COTTON GOODS.

Starch used for finishing linen and cotton goods has usually been prepared in open boilers with a double bottom by the action of direct or indirect heat, and alum was added to give the starch the desired quality.

Mr. F. A. Hempel, of Plauen, in Saxony, has greatly improved on this method by boiling the starch in a closed vessel under a pressure of five atmospheres, while continually agitating it. The apparatus, which is shown in the annexed cut, consists of a copper kettle, A, the lid of which is covered with copper on the underside. A vertical shaft is journaled in the lid, and is rotated by a horizontal shaft through beveled gear wheels. Wings, B, are attached to the vertical shaft and agitate the contents of the kettle. The lower end of the vertical shaft is bored axially, and diagonal channels lead from the central longitudinal channel. Through these channels steam, at a pressure of five or more atmospheres, can be admitted into the kettle, the pressure being regulated by the valve. The starch is passed into the kettle through the opening in the lid, and can be drawn from the kettle through the pipe, D. Steam is admitted through the pipe, C, and the kettle is provided with a pressure gauge safety valve. The operation requires three-quarters of an hour, and the starch is as clear as water. The starch thus obtained is of excellent quality and does not require alum.

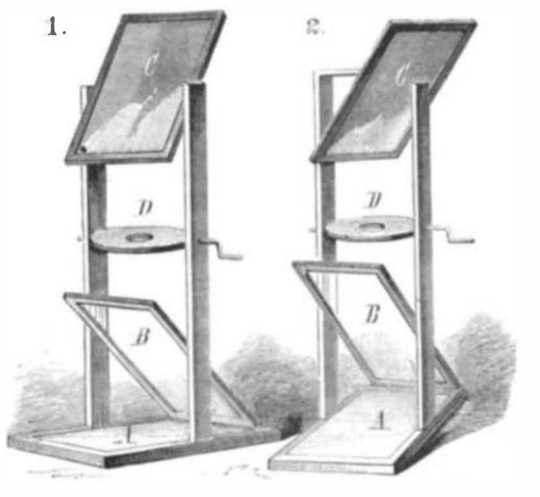


APPARATUS FOR PREPARING STARCH FOR FINISHING LINEN AND COTTON GOODS.

A SIMPLE EXPERIMENT WITH POLARIZED LIGHT.

Scientific toys sometimes awaken a love for further investigation, and experiments in optics often prove more fascinating than was expected. Few of our young readers, we presume, are aware that by the exercise of a little ingenuity and patience they may construct for themselves, without the expenditure of a cent, and from materials to be found in every old garret or store room, a very pretty scientific toy that will afford profit and pleasure for many an idle hour. Many who have seen or read of the Noremberg apparatus have no idea of how easy it is to make one of tolerable excellence. Two pieces of good window glass, a small piece of looking-glass, some strips of wood, and a jack-knife are the principal articles required in its construction.

The principle employed in this form of apparatus is simply the fact that when a ray of light is reflected from a piece of unsilvered glass, making an angle of 35½° with the glass (or 54½° with a perpendicular to the glass), it becomes polarized. Such a ray of polarized light will not bear reflection from a second plate of glass turned at right angles to the first, if it strikes it too at an angle of 54½°. But if a thin plate of mica or other biaxial mineral is placed in the path of this ray it will not only be rendered visible, but be beau-



POLARIZING APPARATUS

tifully colored, the color depending upon the thickness of the mica and its position.

It is evident, then, that we need, first of all, some means of measuring and constructing an angle of 35½° and 54½°. If a circular protractor or scale of chords be not at hand, the following will give sufficiently accurate results:

Take a large sheet of paper or cardboard having a right angle at one corner, and measure off 10 inches in one direction and 14 inches in the other. Join the point thus formed by a straight line, and you will have a right angled triangle, one angle of which is 54½° (that opposite the longer side) and the other angle is 35½°. An ordinary business card is cut so as to have the same sized angles and used in constructing the apparatus. Procure a piece of thin wood 3 inches square for a base, two strips of wood ½ by ¾ inch, and 9 and 10 inches long, respectively, for uprights. From a broken mirror cut a piece 2¼ inches square. A piece of quartz or very sharp steel will answer instead of a diamond to scratch the glass if care is used in breaking it. Also two pieces of clear window glass, each 2¼ by 4 inches. One of these is covered on one side with dull black paper, over which is laid a piece of cardboard, and the whole bound together with a strip of black paper. A circle is also cut from cardboard, and a hole cut in it as large as a nickel five cent piece. A groove is cut in each of the uprights about two inches from the lower end in a slanting direction, so as to have an angle of 35½° with the upright, and 54½° with the base. At a height of about 8 inches are two similar grooves, at the same angle, but in the opposite direction to the lower ones instead of parallel to them. This groove is made wide enough to receive the glass backed with cardboard. Two uprights are now attached to the base, by tacks or otherwise, at such a distance apart as to allow the strips of clear glass to slide tightly in the grooves, while the mirror, placed flat upon the base, is received in notches at the foot of the uprights. The blackened glass is slipped into the upper pair of grooves face downward, the transparent one is slid into the lower grooves, and at a point midway between them the circle of black cardboard is held in position by short pins passed through the uprights on either side. Place the apparatus thus arranged before a window so that the upper edge of the upper glass is about on the level of the eye, or a little below it. On looking into this upper glass a bright circle will be seen reflected in it. Take some pieces of clear mica, and place them one, two, or three at a time, in various positions on the pasteboard disk, which can also be turned at various angles. In certain positions the circle, as viewed in the upper plate of glass, will acquire beautiful colors which change with every movement of the mica. Other biaxial minerals in thin sections do the same.

By a slight modification of the apparatus it can be made to prove the other peculiar property of polarized light. (See figure 2). Remove the upper plate of glass, and attach to its reverse the oblique surface of a large cork cut at an angle of 35½°. The cork may be tacked or glued to a thin piece of wood by its large end, and this strip of wood fastened to the top of the longer upright, after the manner of a gibbet. This will suspend the strip of glass at the same angle as before, but at right angles to the lower one, and the observer, in order to see the disk, must stand with his side to the window and look just over the top of the shorter upright. Instead of seeing a bright spot as before, the center will be comparatively dark. But on replacing the mica on the revolving stage, rich colors again appear. Beautiful effects can be obtained by combining and overlapping strips of mica of different thicknesses.

A thin section of a crystal of quartz cut perpendicular to the axis also produces a very pretty series of colors, depending upon the thickness and the angle of the plain glass plates.

Instead of wooden uprights the plates of glass may be mounted on wire apparatus, as described by Hopkins in the SCIENTIFIC AMERICAN of December 4, 1880, page 354, making use of the principles illustrated in Figs. 16 and 20, with necessary modifications.

The accompanying illustration shows the second position. A is the horizontal piece of silvered glass, B is the clear piece of window glass, C is the blackened glass, D is the disk of black pasteboard or revolving stage on which the mica is placed. E. J. H.

Atlanta, Feb. 5, 1881.

RECENT INVENTIONS.

Messrs. Robert F. Dobson, of Darlington, Wis., and Isaac Dobson, of Lincoln, Neb., have invented a process for tanning hides which is claimed to involve comparatively little labor, time, and expense, and which injures the fiber of the leather less than processes heretofore employed, and by which the leather produced is made stronger and more durable than that heretofore produced. They place the hides for ten days, or thereabout, in a bath of strong brine and tanning extract, and then subject the hides to the fumes of sulphur in an air-tight compartment for from twelve to twenty-four hours or more.

A steam-supplying apparatus, patented by Milton W. Hazelton, of New York city, combines with a heating tank appliances for supplying steam either for power or heating purposes. A central heater is employed to heat a mass of water to a prescribed temperature higher than the boiling point. This hot water is carried through pipes to local steam generators, in which the pressure upon the heated water being reduced steam is generated. The water in these generators, cooled by the generation of steam therefrom, is led back to the central heating tank for reheating.

Mr. David S. Thomas, of North Platte, Neb., has patented a windmill which supplies an improved device for controlling or adjusting the sails or vanes. A clutch wheel or spider and a spirally grooved loose sleeve, to which is attached a small vane, are fixed on the axle of the wheel. The sleeve engages with a stud, and, when turned in one direction, draws the wind wheel into clutch with the spider, whereby the vanes are set to the wind. The vane on the loose sleeve also acts to adjust or throw the vanes flat in a high wind.

Mr. John T. Stoll, of Sacramento, Cal., has patented a horse collar pad for collars of the kind which open at the top, and which supplies an upper pad of such form and material as will securely keep the collar in its proper shape, prevent the strap which holds the hames together from pressing through the top of the collar, and which is supplied with a hook or holding iron, that prevents the hame strap from slipping forward, and keeps the hames in their place on the collar.

Mr. John W. McKee, of Moselle, Mo., has patented a drag-sawing machine which may not only be used for sawing down trees, but which may also be advantageously used for cutting the trees into logs when felled. It may conveniently be moved from place to place.

Mr. Tom Owen Memery, of Key West, Fla., has patented a sewing machine shuttle provided with a hinged spindle for receiving the spool and a friction nut and screw, which also sustains the moving end of the spindle when in position for use, thus permitting the ready application and removal of the spool.

Mr. Elihu Quimby, of Hanover, N. H., has patented an automatic time register and alarm, which acts to cause an alarm at any desired place in case of failure of the watchman to perform his duty, obtains a permanent record indicating the time of any dereliction, permits the watchman to operate the distant signal at any time independently of the ordinary working of the apparatus, permits a person at such distant point to distinguish regular from unusual signals, and which cannot be tampered with. A novel combination of electrical devices and clockwork effect the results stated.

Mr. Frank W. Mix, of Terryville, Conn., has patented an indicator lock which prevents the opening of the lock and the subsequent restoration of the indicator dials to their former positions by turning the key back. A peculiar construction and arrangement of an obscuring disk closes the openings in the face plate to prevent the entrance of dirt, rain, etc.

Mr. Edwin L. Barber, of Henrietta, Texas, has patented a water cooler wherein the vessel holding the water is surrounded with felt attached to the inner side of a casing for the vessel. The casing has apertures formed therein for the escape of vapor arising from the felt which is wetted in use, and troughs are provided to convey away the drip.

An extension straw stacker has been patented by Mr. William Holmes, of Ashland, Ohio, which is so constructed that it may be extended or contracted without affecting the tension of the endless belt carrier or of the adjusting chains.

Elementary Physics.

BY I. J. OSBUN.

A teacup with a little water; a small sponge; a sheet of blotting paper six inches square, folded twice, so that all the corners shall come together; pin three of the corners together, press the others away, thus forming a little pocket or filter; a mixture of pulverized chalk, or ashes and water; a bowl of water; two blocks of wood; two pieces of sole leather; if possible, a magnifying glass; a narrow bottle or test tube; some alcohol or naphtha or kerosene; some cotton; a glass tube one fourth inch inside diameter, one foot long, closed at one end; a test tube; a shingle or strip of pasteboard; a knitting needle; a brick; a short candle; a bottle or test tube filled with colored liquid; a piece of pipe stem or glass tube; a lamp; a dry bottle fitted with cork, and glass tube or tobacco pipe.

EXPERIMENT.	OBSERVATION.	INFERENCE.
Into a teacup containing two tablespoonfuls of water thrust a dry sponge, and then lift the sponge from the cup.	No water left in the cup.	The water in the cup entered spaces in the sponge.
Squeeze the sponge.	Water drops out.	
Into a little bag of unsized paper pour a mixture of powdered chalk and water.	The water passes through, and the chalk remains upon the paper.	Between the fibers of the paper there are spaces large enough to allow the molecules of water to pass through, but too small for the particles of chalk.
Into a bowl of water put a little block of unpainted pine wood, and a little piece of sole leather. Set aside for a day, then take the wood and leather from the water, and compare their weight with equal-sized pieces of dry wood and leather, by lightly tossing them in the hand.	The wet pieces are much heavier than the dry.	Water has entered spaces in the wood and leather.
Look carefully at the sponge, paper, wood, and leather, if possible, with a microscope.	Little spaces between the fibers of the different bodies.	In many bodies there are little spaces, visible to the naked eye or by the aid of a microscope, called pores.
Into a bottle, or test-tube, *full* of alcohol, naphtha, or kerosene, attempt to thrust some cotton from a roll of batting.	A great quantity of cotton may be put into the bottle, while the liquid does not overflow.	Between the molecules of the liquid are spaces for the molecules of cotton to enter, and between the molecules of cotton there are spaces for the liquid to enter.
Half fill a long, narrow glass tube with water; upon this pour alcohol until it is full. Close the tube with the thumb, invert it, and shake so as to mix the liquids.	The tube is no longer full, while none of the liquid has escaped.	The molecules of water must have entered into little spaces between the molecules of alcohol, and *vice versa*.
Heat to boiling in a test tube half a teaspoonful of strong ammonia.	A penetrating odor of ammonia about the mouth of the tube.	The tube must be full of ammonia gas.
Quickly invert the tube full of ammonia gas over some water. Shake the tube, but keep its mouth under water.	Water rises and fills tube.	There must be spaces between the molecules of the ammonia gas.
Examine the cotton, liquid, and gas.	There are no spaces visible.	Between the molecules of solids, liquids, and gases there are invisible spaces or pores.

Definition.—Pores that are visible are called *sensible pores*, and pores that are invisible are called *physical pores*.

Notes.—Matter is made up of molecules, and these in turn are made up of atoms. Between the atoms and between molecules there are spaces.

Lean a shingle against a knitting needle for a brace, and heat the needle.	The shingle falls because of the expansion of the needle.	The molecules of iron have been separated. In hot iron the spaces between the molecules are larger than in cold iron.
*Carefully heat a bottle or test tube with colored water, and fitted with a cork, through which passes a narrow glass tube, or a pipe stem.	The water rises in the tube, and overflows.	The molecules of water have been separated. In warm water the spaces between molecules are larger than in cold water.
Cool the bottle.	The liquid lowers in the tube.	When water is cooled the molecules come together.
†Carefully heat a bottle or test tube, filled with air, and fitted with a narrow, bent glass tube, or a tobacco pipe, holding the end of the tube or pipe stem under water in a tumbler.	Bubbles of air escape from the tube and rise through the water.	The molecules of air have been separated. In warm air the spaces between the molecules are larger than in cold air.
Cool the bottle.	Water rises through the tube and enters the bottle.	When air is cooled the molecules come near together.

When solids, liquids, and gases are heated the molecules are separated.

Note.—A change of temperature in matter is attended with a change of position in its molecules.

Examples.—In the parts of a stove when a fire is built. In the mercury of a thermometer. In the earth and air when the sun rises. In the walls of a cold room when a person enters it.

Regard all the objects of matter about us, solids, liquids, and gases.	They are constantly changing in temperature, from warm to cold, or cold to warm.	The molecules must be constantly in motion.

—*Journal of Education.*

* Heat a piece of glass tubing, and when the glass is soft, remove it from the flame and quickly draw the hands apart. A tapering, narrow tube will thus be formed, the large end of which may be fitted to a cork that has been pierced and neatly filed with a slender, round file. The bottle should be so full of water that when the cork is pushed in, the liquid, which is colored with violet ink, shall rise half way up the glass tube, or entirely to the top of the pipe stem.

† The narrow glass tube is bent by warming, so that its free end may be conveniently held under the water in a tumbler. A tobacco pipe may be fitted to a bottle or test tube by means of a common tapered cork, the large end of which shall tightly fit the pipe bowl, while the small end fits the neck of the bottle. The cork, of course, must have a hole punched through it

Making Iron Columns Secure.

So many accidents have occurred at fires to life and property by the sudden giving away of iron columns used for supports to the various floors of buildings, that such columns are looked upon with distrust by firemen, and their use discouraged. When they become heated by fire they warp and twist, and if water is thrown upon them they are apt to break entirely, thus letting the upper floors fall. It was in consequence of the giving away of the iron columns at the Broadway fire, some time ago, that the floors from cellar to roof fell in, and two firemen who were on the roof were hurled to a terrible death in the seething furnace within the building. All large cities are full of buildings whose several floors are supported on iron columns, and, in case of fire, they are quite as likely to collapse as did the one we refer to. Our building laws, which are yet crude and imperfect, permit their use, and, as they are cheaper than most anything that could be used instead, they are still favorites with builders. The very best thing to take the place of iron columns would be columns of brick, but objection is made to them that they take up too much room and are not ornamental.

Many experiments have been tried with a view to making iron columns fireproof, or at least sufficiently so to be able to stand a small fire in their neighborhood without bending, and thus bringing the entire building to the ground in ruins, long before it would be destroyed by the fire alone. Casing the columns with wood, asbestos, brickwork, etc., has been tried, and some of the methods have been described in the *Journal.* Recently two more suggestions have been made. One is to inclose the columns in rings of terra cotta, put on over the top when the column is set up. These would act as a shield to keep off the heat till the fire could be subdued. The plan is simple and inexpensive, and has the added advantage of giving opportunity to make the columns highly ornamental, as terra cotta readily lends itself to decorative treatment.

The second plan is to fill the columns with water. To do this the plates or castings, usually placed between the columns where they stand one over the other, have holes or openings of some kind, so that there is a free communication from column to column, from the bottom to the top of the building. Where columns are already erected, short pipes are used to connect them at each floor. The uppermost column is also provided with a small escape-pipe, passing through the roof to the open air. At the base of each tier of columns a pipe is connected with the street mains, so that all the columns may be filled with water, either permantly or on emergency. When thus filled with water and provided with an escape for the expansion of the water or steam, the columns would stand unharmed until every floor was burned out. Were the girders also hollow and filled with water in the same manner, both girders and columns would undoubtedly stand intact, even after all the floors and the roof had fallen in, and they could be used again in rebuilding. The system has the merit of cheapness and ease of application, and is patented in this country. We have little confidence, however, in iron columns under the conditions incident to a great fire, and the sooner their use is prohibited by law the better it will be for the public.—*Fireman's Journal.*

Salicylic Acid in Foot-and-Mouth Disease of Cattle.

The Duke of Brunswick has of late successfully combated the ravages of this much dreaded enemy on his estate at Stampen, near Oels, in Prussian Silesia, by treatment with salicylic acid, the well-known antiseptic. Instead of several weeks being required to effect a cure with the remedies hitherto employed, truly surprising results have been brought about within a few days by this new treatment. A solution of the acid is prepared by pouring some hot water on about three tablespoonfuls of salicylic acid in an earthen vessel, and adding lukewarm water to make up a gallon. The mouth and feet of the diseased animal should be carefully washed three times a day with this liquid, and the tops of the hoofs well powdered with the dry acid after each ablution. The effect will, moreover, be greatly increased by salicylating the drinking water of the beasts by the addition of two tablespoonfuls of the acid dissolved in hot water. During the above treatment great attention must be paid to the perfect cleanliness of the stables or sheds. The dung must be saturated with salicylic acid solution to prevent further infection, for it is chiefly in the dung that the germs of the disease are to be found.

Changes in the Relative Elevation of Land and Sea.

The impression that the northeastern coast of the American continent is slowly rising, and Professor Shaler's estimate of the rate of emergence in progress as being over a foot, and perhaps as much as three feet in a century, has been recently denied (*American Journal of Science and Arts*) by Mr. Henry Mitchel, who states, in the Coast Survey Report for 1877, that the salt marshes are still, as they were in the time of the early explorers, at ordinary high water level, and that the rocks upon our coast, long notorious as dangerous to navigation, have not risen since they were first discovered. In his statements ancient maps and documents are cited, and the conditions of the various rocks are considered in detail. He claims that no tilt in either direction has taken place in the Gulf of Maine. But eastward of longitude 64° 13′, and especially in Newfoundland, great changes present themselves in the comparison of charts, the depths appearing to be at some points less and at other points greater now than formerly.